MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

HMB2011 – INTRODUCTION TO MOLECULAR BIOLOGY

(All section / Groups)

8 MARCH 2016
9.00 a.m. – 11.00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **12** printed pages including the cover page with **6** questions only.
2. Attempt only **FIVE** out of **SIX** questions. All question carries equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the spaces provided in this question paper.

QUESTION 1

a. What is a riboswitch?

[2 marks]

b. Briefly describe each component of the riboswitch.

[2 marks]

Continued.....

c. With the aid of diagram, explain how the flavine mononucleotide riboswitch abort the transcription process.

[5 marks]

Continued.....

d. Describe "in-line probing".

[1 mark]

QUESTION 2

a. List four chemical reactions that can cause DNA damage.

[2 marks]

b. Ethidium bromide is commonly used in molecular biology lab in order to visualize DNA in the gel electrophoresis. What effect does this chemical have on DNA? What are the potential biological consequences of this?

[4 marks]

Continued.....

c. What is the role of base flipping in DNA repair? What does the repair machinery accomplish by relying on this phenomenon?

[4 marks]

QUESTION 3

a. Gel electrophoresis is an important genetic tool to separate DNA molecules. Towards which electrode do nucleic acid molecules migrate during gel electrophoresis, the positive electrode or the negative electrode?

[1 mark]

b. Explain how to prepare 1.5% of agarose gel using 70ml TAE buffer.

(Show your calculation step) **[1 mark].**

Continued.....

c. Name three analytical roles of gel electrophoresis.

[3 marks]

d. State three parameters researcher can manipulate to get the best resolution of gel electrophoresis.

[3 marks]

e. What role do restriction enzymes play in bacteria? How do bacteria protect their own DNA from the action of restriction enzymes?

[2 marks]

Continued.....

QUESTION 4

a. Describe the mechanism of interference RNA (RNAi) using a simple diagram.

[5 marks]

b. By knowing the mechanism of RNAi, in your opinion, in which way can the RNAi mechanism be exploited for beneficial use? Give two applications.

[2 marks]

Continued.....

c. In which way can bioinformatics contribute in the application of the technology?

[2 marks]

d. State two advantages of next generation sequencing (NGS) profiling for RNAi screening?

[1 marks]

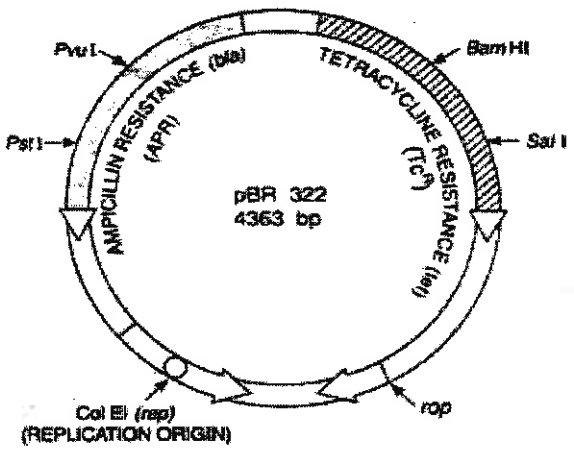
QUESTION 5

a. Explain why genetic recombination is an important process?

[2 mark]

Continued.....

b. An ampicillin-resistant, tetracycline-resistant plasmid, pBR322, is cleaved with BamHI, which cleaves within the tetracyclin gene. The cut plasmid is ligated with BamHI-digested *Drosophila* DNA to prepare a genomic library, and the mixture is used to transform *E. coli* JM109.



i. Which antibiotic should be added to the medium to select cells that have incorporated a plasmid?

[1 mark]

ii. What growth pattern should be selected to obtain plasmids containing *Drosophila* inserts?

[1 mark]

iii. How can you explain the presence of colonies that are resistant to both antibiotics?

[1 mark]

Continued.....

c. A geneticist uses a plasmid for cloning that has a gene that confers resistance to ampicillin and the *lacZ* gene. The geneticist inserts a piece of foreign DNA into a restriction site that is located within the *lacZ* gene and transforms bacteria with the plasmid. Explain how the geneticist could identify bacteria that contain a copy of a plasmid with the foreign DNA.

[4 marks]

d. During the cloning procedure, you used SOC media as super optimal broth supplemented with 20mM glucose. You prepared 100ml of 1M glucose stock solution. How many milliliter glucose you should take from the stock solution if you want to prepare 60ml of SOC media?

[1 mark]

Continued.....

QUESTION 6

In phage lambda,

a. How does lamda repressor act as a repressor?

[1 mark]

b. Why does the level of lamda repressor have to be tightly controlled? How is the process executed?

[5 marks]

Continued.....

c. RecA protein has many biochemical activities, including bringing homologous DNA molecules together, binding to single-stranded and double-stranded DNA, promoting various types of strand exchange, and ATP hydrolysis. RecA also stimulates proteolytic activity in other proteins promoting the cleavage of lamda (λ) repressor and of LexA, a repressor of genes involved in DNA repair. Does this make biological sense that RecA is involved in homologous recombination as well as in the proteolytic cleavage of these regulatory molecules?

[4 marks]

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